CLAIMS

What is claimed is:

1. An excimer or molecular fluorine laser system, comprising:

a master oscillator including therein a first discharge chamber filled with a first gas mixture, the first discharge chamber containing a first plurality of electrodes connected to a first discharge circuit for energizing the first gas mixture and generating an oscillator beam;

a power amplifier including therein a second discharge chamber filled with a second gas mixture, the second discharge chamber containing a second plurality of electrodes connected to a second discharge circuit for energizing the second gas mixture and amplifying the oscillator beam received from the master oscillator for output as an output beam; and

an acousto-optical modulator positioned along a beam path between the master oscillator and the power amplifier, the acousto-optical modulator operable to selectively control an amount of the oscillator beam to be received by the power amplifier.

2. A laser system according to claim 1, wherein:

the acousto-optical modulator can selectively control the amount of the oscillator beam to be received by the power amplifier by deflecting at least one portion of the oscillator beam when the acousto-optical modulator is activated, such that said at least one portion is not amplified by the power amplifier.

3. A laser system according to claim 1, wherein:

the acousto-optical modulator is activated during an initial recovery period of the oscillator beam.

4. A laser system according to claim 1, wherein:

the acousto-optical modulator includes a transparent media coupled with a piezo-electric transducer, the transducer capable of being excited at a frequency

producing an acoustic wave in the transparent media, thereby modulating the refractive index of the transparent media.

5. A laser system according to claim 4, wherein:

the piezo-electric transducer is capable of being excited at a frequency in the range of about 20 MHz to about 200 MHz.

6. A laser system according to claim 4, wherein:

the piezo-electric transducer is operated at a frequency operable to cause the oscillator beam to be deflected by a predetermined amount.

7. A laser system according to claim 4, wherein:

the piezo-electric transducer receives a first input whereby the acousto-optical cell transmits oscillator beam to the power amplifier.

8. A laser system according to claim 4, wherein:

the piezo-electric transducer receives a second input whereby the acousto-optical cell transmits at most 20% of the oscillator beam to the power amplifier.

9. A laser system according to claim 4, wherein:

the transparent media is selected from the group consisting of CaF_2, MgF_2, BaF_2, quartz, de-hydrated or fluorinated fused silica, and sapphire.

10. A laser system according to claim 1, further comprising:

a pair of cylindrical lenses positioned on either side of the acousto-optical modulator along the beam path between the master oscillator and power amplifier, the pair of cylindrical lenses operable to match a beam size of the oscillator beam to an active area of the acousto-optical modulator.

11. A laser system according to claim 1, further comprising:

a spatial filter positioned along the beam path between the master oscillator and power amplifier, the spatial filter operable to further separate the deflected portion from a transmitted portion.

12. A laser system according to claim 1, further comprising:

an aperture positioned along the beam path between the acousto-optical modulator and power amplifier, the aperture operable to block the deflected portion of the oscillator beam.

13. A laser system according to claim 1, wherein:

the power amplifier is further operable to compensate for any energy loss in the oscillator beam resulting from the oscillator beam passing through the acousto-optical modulator.

14. An excimer or molecular fluorine laser system, comprising:

a master oscillator including therein a first discharge chamber filled with a first gas mixture, the first discharge chamber containing a first plurality of electrodes connected to a first discharge circuit for energizing the first gas mixture and generating an oscillator beam;

a power amplifier including therein a second discharge chamber filled with a second gas mixture, the second discharge chamber containing a second plurality of electrodes connected to a second discharge circuit for energizing the second gas mixture and amplifying the oscillator beam received from the master oscillator for output as an output beam; and

a first acousto-optical modulator positioned along a beam path between the master oscillator and the power amplifier, the first acousto-optical modulator operable to redirect at least a first portion of the oscillator beam in a first plane; and

a second acousto-optical modulator positioned along a beam path between the first acousto-optical modulator and the power amplifier, the second acousto-optical

modulator operable to redirect at least a second portion of the oscillator beam in a second plane.

15. A laser system according to claim 14, wherein:

the second plane is substantially orthogonal to the first plane

16. A laser system according to claim 14, further comprising:

a feedback sensor positioned in an output path of the output beam for measuring a pointing angle of the output beam, the feedback sensor in communication with the first and second acousto-optical modulators such that at least one of the first and second acousto-optical modulators can redirect the oscillator beam.

17. A laser system according to claim 14, further comprising:

a directional control module operable to receive a position signal from the feedback sensor and provide a control signal to a transducer for at least one of the first and second acousto-optical modulators in order to redirect the oscillator beam.

18. A laser system according to claim 14, wherein:

at least one of the first and second acousto-optical modulators includes a transparent media coupled with a piezo-electric transducer, the transducer capable of being excited at a frequency producing an acoustic wave in the transparent media, thereby modulating the refractive index of the transparent media in order to control the direction of the oscillator beam passing through the transparent media.

19. A laser system according to claim 14, wherein:

the piezo-electric transducer is capable of being excited at a frequency in the range of about 20 MHz to about 200 MHz.

20. A laser system according to claim 14, wherein:

the transparent media is selected from the group consisting of CaF_2, MgF_2, BaF_2, quartz, de-hydrated or fluorinated fused silica, and sapphire.

21. A laser system according to claim 14, further comprising:

a pair of cylindrical lenses positioned along the beam path between the master oscillator and power amplifier, the pair of cylindrical lenses operable to match a beam size of the oscillator beam to an active area of at least one of the first and second acousto-optical modulators.

22. A laser system according to claim 14, further comprising:

a spatial filter positioned along the beam path between the master oscillator and power amplifier, the spatial filter operable to further separate the redirected first and second portions from a transmitted portion.

23. A laser system according to claim 14, further comprising:

an aperture positioned along the beam path between the second acousto-optical modulator and the power amplifier, the aperture operable to block a transmitted portion of the oscillator beam.

24. A laser system according to claim 14, wherein:

the power amplifier is further operable to compensate for any energy loss in the oscillator beam resulting from the oscillator beam passing through the first and second acousto-optical modulators.

25. A laser system according to claim 14, further comprising:

a least one optical decoupler positioned along a path of the oscillator beam between the power amplifier and the master oscillator, the optical decoupler capable of at least one of reducing energy fluctuations and suppressing spontaneous emissions.

26. A laser system according to claim 14, wherein:

the master oscillator further includes a line-narrowing optics module for narrowing the oscillator beam in the first discharge chamber.

27. A method of generating an output beam in an excimer or molecular fluorine laser system, comprising:

generating an oscillator beam in a master oscillator;

passing the oscillator beam through an acousto-optical modulator, the acousto-optical modulator transmitting the oscillator beam when the modulator is in a first state and deflecting the oscillator beam when the modulator is in a second state; and

passing the oscillator beam received from the acousto-optical cell through a power amplifier, such that the oscillator beam is amplified for output as the output beam.

28. A method according to claim 27, further comprising:

controlling the direction of the oscillator beam received by the power amplifier.

29. A method according to claim 27, further comprising:

setting the acousto-optical modulator to a second state for a portion of the oscillator beam.

30. A method of generating an output beam in an excimer or molecular fluorine laser system, comprising:

generating an oscillator beam in a master oscillator;

passing the oscillator beam through a first acousto-optical modulator, the acousto-optical modulator transmitting the oscillator beam when the modulator is in a first state and deflecting the oscillator beam in a first plane when the modulator is in a second state;

passing the oscillator beam through a second acousto-optical modulator, the acousto-optical modulator transmitting the oscillator beam when the modulator is in a first state and deflecting the oscillator beam in a second plane when the modulator is in a second state; and

passing the oscillator beam through a power amplifier, such that the oscillator beam is amplified for output as the output beam.

31. A method according to claim 30, further comprising:

measuring a pointing angle of the output beam.

32. A method according to claim 31, further comprising:

adjusting at least one of the first and second acousto-optical modulators in response to the measured pointing angle.

33. A method according to claim 32, further comprising:

further separating the transmitted beam and deflected beam using a spatial filter between the master oscillator and power amplifier.

34. A method according to claim 32, further comprising:

blocking the transmitted beam using an aperture positioned between the master oscillator and power amplifier.

35. A method of generating an output beam in an excimer or molecular fluorine laser system, comprising:

generating an oscillator beam in a master oscillator;

transmitting the oscillator beam to a power amplifier;

in a first operational state amplifying the oscillator beam received by the power amplifier; and

in a second operational state providing no amplification to the oscillator beam received by the power amplifier.

36. A method according to claim 35, further comprising:

in the first operational state, applying a trigger ionization voltage to ionization electrodes of the power amplifier so that a discharge occurs in the power amplifier which amplifies the oscillator beam.

37. A method according to claim 35, further comprising:

controlling a direction of the oscillator beam before the oscillator beam passes through the power amplifier.

38. A method according to claim 35, further comprising:

measuring a pointing angle of the output beam; and

controlling a direction of the oscillator beam based on the pointing angle.

39. A method of generating an output beam in an excimer or molecular fluorine laser system, comprising:

generating an oscillator beam in a master oscillator;

in a first operational state, passing the oscillator beam through a power amplifier, such that the oscillator beam is amplified for output as the output beam; and

in a second operational state, preventing the oscillator beam from passing through the power amplifier.